HOW ARE SINGLE-PARENT HOUSEHOLDS DISTRIBUTED ACROSS THE UNITED STATES?

TEACHER VERSION

Subject Level:
Middle School Math

Grade Level:
7

Approx. Time Required:
60 minutes

Learning Objective:

- Students will be able to create and compare dot and box plots of census data.

United States Census Bureau

Classrooms Powered by Census Data

STATISTICS IN SCHOOLS

Activity Description

Students will create and compare dot and box plots that show the percentages of single-mother and single-father households in different regions of the United States.

Suggested Grade Level:
7

Approximate Time Required:
60 minutes

Learning Objective:
- Students will be able to create and compare dot and box plots of census data.

Topics:
- Center
- Shape
- Spread

Skills Taught:
- Comparing and interpreting dot and box plots
- Comparing the shapes of data distributions
- Creating a box plot
- Creating a dot plot

Materials Required

- The student version of this activity, 11 pages
- Rulers

A graphing calculator, graphing software (e.g., Microsoft Excel), or other graphing technology is optional.

Activity Items

The following items are part of this activity. Items, their sources, and any relevant instructions for viewing them online appear at the end of this teacher version.

- Item 1: U.S. Map of Census Bureau Regions
- Item 2: Single-Parent Households by Sex and Census Bureau Region: 2013

For more information to help you introduce your students to the U.S. Census Bureau, read "*Census Bureau 101 for Students*." This information sheet can be printed and passed out to your students as well.

Standards Addressed

See charts below. For more information, read "*Overview of Education Standards and Guidelines Addressed in Statistics in Schools Activities*."

Common Core State Standards for Mathematics

Standard	Domain	Cluster
CCSS.MATH.CONTENT.HSS.ID.A.2 Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.	ID – Interpreting Categorical & Quantitative Data	Summarize, represent, and interpret data on a single count or measurement variable.

Common Core State Standards for Mathematical Practice

Standard
CCSS.MATH.PRACTICE.MP4. Model with mathematics. Students will use various measures to create visual representations modeling census data.
CCSS.MATH.PRACTICE.MP5. Use appropriate tools strategically. Students will use graph templates or graphing technology to make mathematical models.
CCSS.MATH.PRACTICE.MP6. Attend to precision. Students will work carefully with lists of percentages in decimal form to perform their calculations correctly.

National Council of Teachers of Mathematics' Principles and Standards for School Mathematics

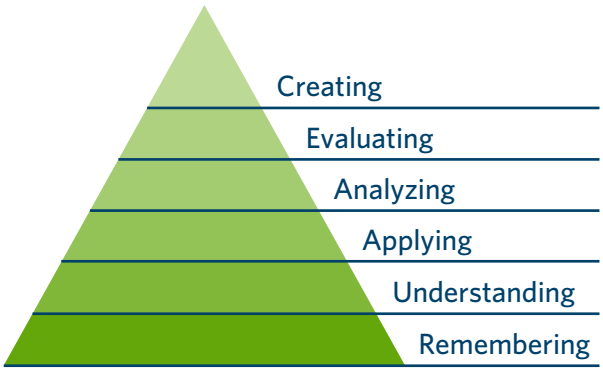
Content Standard	Students should be able to:	Expectation for Grade Band
Data Analysis and Probability	Formulate questions that can be addressed with data and collect, organize, and display relevant data to answer them.	Formulate questions, design studies, and collect data about a characteristic shared by two populations or different characteristics within one population.
Data Analysis and Probability	Select and use appropriate statistical methods to analyze data.	Find, use, and interpret measures of center and spread, including mean and interquartile range; Discuss and understand the correspondence between data sets and their graphical representations, especially histograms, stem-and-leaf plots, box plots, and scatterplots.

Guidelines for Assessment and Instruction in Statistics Education

GAISE	Level A	Level B	Level C
Formulate Questions		X	
Collect Data			
Analyze Data		X	
Interpret Results		X	

Bloom's Taxonomy

Students will ***apply*** their mathematics skills to ***create*** and compare dot and box plots so they can ***analyze*** census data.



Teacher Notes

Before the Activity

Students must understand the following key terms:

- **Household** – a housing unit containing any number of people; every person living in that housing unit makes up the household.
- **Householder** – the main person, at least 15 years old, who rents or owns the housing unit
- **Median** – a measure of center in a set of numerical data, identified as the value appearing at the middle of a sorted version of the list (or the mean of the two middle values if the sorted list contains an even number of values)
- **Range** – the numerical difference between a data set's maximum value and minimum value
- **Outlier** – a data point that is well outside of the expected range of values or does not follow the overall pattern of the other data points
- **Spread** – the amount of variability among the values in a data set
- **First quartile (Q1)** – also known as lower quartile, the value that divides a sorted data set into the smallest 25 percent of the data and the largest 75 percent
- **Third quartile (Q3)** – also known as upper quartile, the value that divides a sorted data set into the smallest 75 percent of the data and the largest 25 percent
- **Interquartile range (IQR)** – a measure of variability in a set of numerical data to indicate the difference between the first and third quartiles of the data set
- **Sample** – a selection of observations from a population
- **Population** – the entire set of data from which samples can be taken

If teachers want students to use graphing technology to create their dot and box plots, teachers should review the technology with students or teach them how to use it. Teachers could also preload the data into the graphing technology to save time and to allow students to focus on analyzing their plots. Teachers should also be aware that some software programs use different methods for calculating quartiles, which may generate different values than those provided in the sample student answers (derived from TI Teacher Software).

Teachers should review with students that there are various family structures and why it is important for the U.S. Census Bureau to know about them, such as to better understand how the American family has changed over time. Teachers should also note that parents (householders) who have a co-habiting partner are included in these "single-parent" households.

Teachers should divide students into groups of four, with each group member creating the dot and box plots for one geographic region of the country (South, West, Northeast, or Midwest).

During the Activity

Teachers should monitor students as they work.

After the Activity

Teachers should lead a class discussion about students' observations and analyses, reminding them to use their calculations to support their points. In this discussion, students should consider comparisons between male and female single-parent households as well as among households in the four geographic regions.

Extension Ideas

- Teachers could have more advanced students work in pairs instead, with each partner making dot and box plots for two geographic regions, and then individually comparing the plots for those two regions before comparing all four regions with their partner.
- Teachers could direct students to analyze data on other types of households, using the source data for this activity (*factfinder.census.gov/bkmk/table/1.0/en/ACS/13_1YR/DP02/0100000US.04000*).
- Teachers could have students calculate and compare the means for male and female single-parent households in each geographic region.

Student Activity

Click ***here*** to download a printable version for students.

Activity Items

The following items are part of this activity and appear at the end of this student version.

- Item 1: U.S. Map of Census Bureau Regions
- Item 2: Single-Parent Households by Sex and Census Bureau Region: 2013

Student Learning Objective

- I will be able to create and compare dot and box plots of census data.

In this activity, you will look at 2013 census data for two types of households in four different geographic regions of the United States: One type is of a man and his children, and the other type is of a woman and her children. In both household types, there was no spouse listed as living in the home at the time of the interview. You will use these data to create dot plots and box plots that will help you see trends in the data.

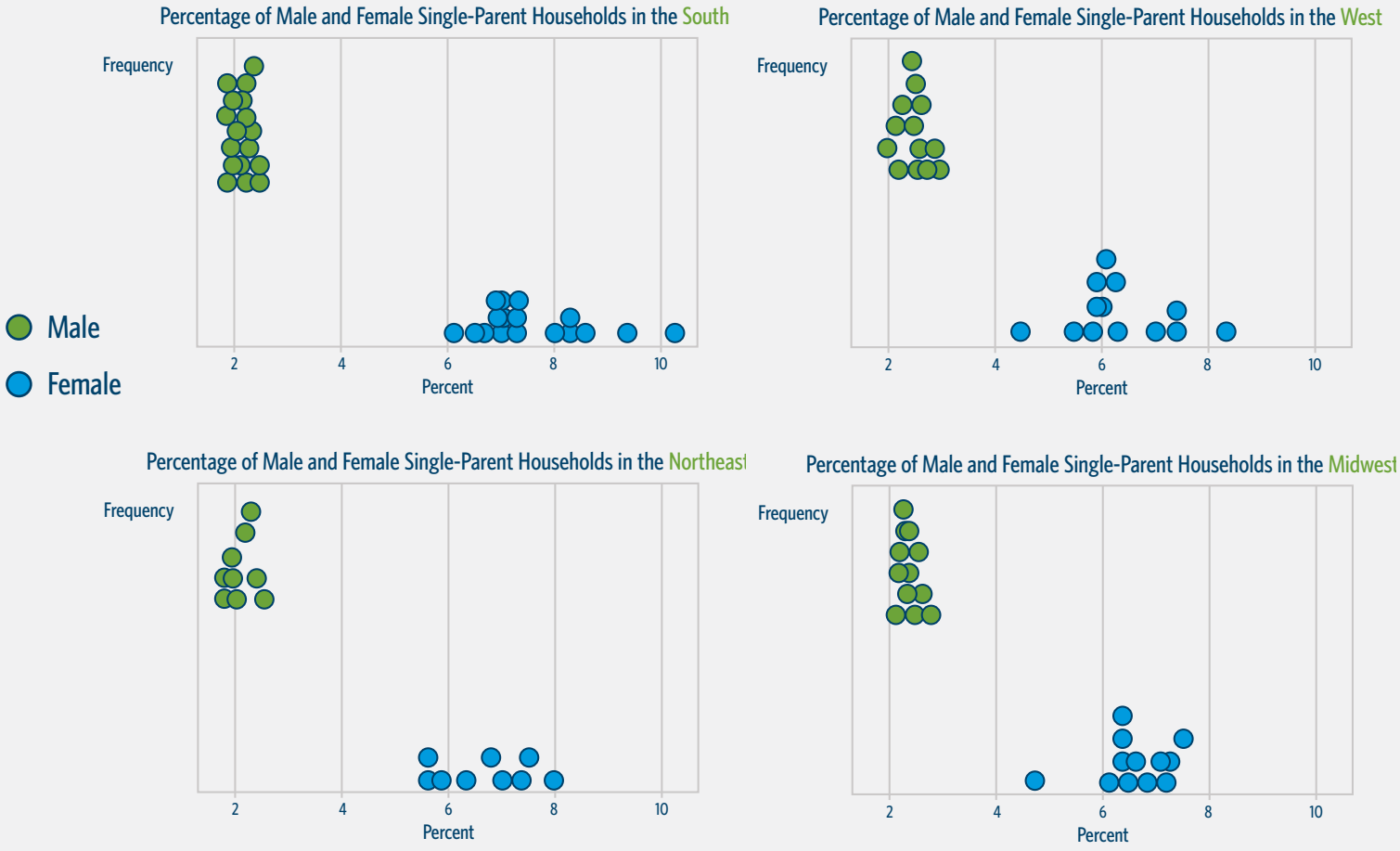
Before you get started, review **Item 1: U.S. Map of Census Bureau Regions** and **Item 2: Single-Parent Households by Sex and Census Bureau Region: 2013**, which show the percentages of single-mother and single-father households in each geographic region.

With your group of four, decide who will complete the work for which region, so that all four are covered, then circle your assigned region below:

- South
- West
- Northeast
- Midwest

1. On the following graph template, make two dot plots for the data in your region — one for male single-parent households and the other for female ones — with one above the other (doesn't matter which is on top). Be sure to fill in the blank for your region at the top as well as the blanks along the vertical axis to label each dot plot.

Student dot plots will vary depending on their geographic region. Below are dot plots for each region.



Student answers will vary depending on their assigned region; the following sample answers are for the South.

2. What do you notice about your dot plots?

   Student answers will vary but could include: The dots for the male single-parent households are farther to the left than the dots for female single-parent households.

3. Do you see any clusters of data? If so, describe them.

   Yes. The percentages of male single-parent households are clustered around 1.5 to 3 percent. For female single-parent households, they are less tightly clustered, but most are grouped between 7 and 8 percent.

4. Do you see any outliers? If so, describe them.

   Yes. It appears there is one high outlier in the data for female single-parent households around 10 percent (actual value: 10.3 percent; Mississippi).

5. What differences do you notice between the percentages of male and female single-parent households?

   Student answers will vary but could include: Far more single-parent households are headed by women than by men.

6. In the following table, sort the male and female single-parent householder data for your region from **Item 2** (filling in the blank at the top) from the least to greatest percentage:

Region: **South**

Male Single-Parent Households		Female Single-Parent Households	
State/District	Percentage	State/District	Percentage
Alabama	1.9	West Virginia	6.1
Mississippi	1.9	Virginia	6.7
Virginia	1.9	Florida	6.9
District of Columbia	2.0	Kentucky	7.2
Florida	2.0	Tennessee	7.2
South Carolina	2.0	Arkansas	7.3
Maryland	2.1	Delaware	7.3
Delaware	2.2	Oklahoma	7.3
North Carolina	2.2	District of Columbia	7.6
Arkansas	2.3	Maryland	7.6
Louisiana	2.3	North Carolina	7.7
Tennessee	2.3	South Carolina	8.1
Georgia	2.4	Alabama	8.4
Kentucky	2.4	Texas	8.4
Texas	2.4	Georgia	8.7
Oklahoma	2.6	Louisiana	9.4
West Virginia	2.6	Mississippi	10.3

Sorted data for the other regions are:

West

Male Single-Parent Households		Female Single-Parent Households	
State	Percentage	State	Percentage
Hawaii	2.0	Hawaii	4.6
Oregon	2.2	Utah	5.4
Colorado	2.3	Alaska	5.8
Utah	2.3	Montana	5.9
Wyoming	2.5	Wyoming	5.9
Montana	2.6	Idaho	6.0
Washington	2.6	Washington	6.1
Arizona	2.7	Colorado	6.3
California	2.7	Oregon	6.3
Nevada	2.7	California	7.0
Idaho	2.9	Arizona	7.4
New Mexico	3.0	Nevada	7.4
Alaska	3.2	New Mexico	8.3

Northeast

Male Single-Parent Households		Female Single-Parent Households	
State	Percentage	State	Percentage
Connecticut	1.8	Maine	5.6
Massachusetts	1.8	Vermont	5.6
New York	2.0	New Hampshire	5.8
Pennsylvania	2.0	Pennsylvania	6.3
New Jersey	2.1	New Jersey	6.7
Rhode Island	2.2	Massachusetts	6.9
Vermont	2.3	Connecticut	7.3
New Hampshire	2.5	New York	7.4
Maine	2.7	Rhode Island	7.9

Midwest

Male Single-Parent Households		Female Single-Parent Households	
State	Percentage	State	Percentage
Illinois	2.1	North Dakota	4.6
Minnesota	2.2	Iowa	6.1
Missouri	2.2	Minnesota	6.3
Michigan	2.3	Nebraska	6.3
Nebraska	2.3	Wisconsin	6.3
Ohio	2.3	Kansas	6.5
Kansas	2.4	South Dakota	6.6
Wisconsin	2.4	Illinois	6.9
Indiana	2.5	Missouri	7.1
Iowa	2.6	Indiana	7.3
North Dakota	2.6	Michigan	7.3
South Dakota	2.8	Ohio	7.5

7. Use your sorted data to calculate and record the measures in the table below:

Region: **South**

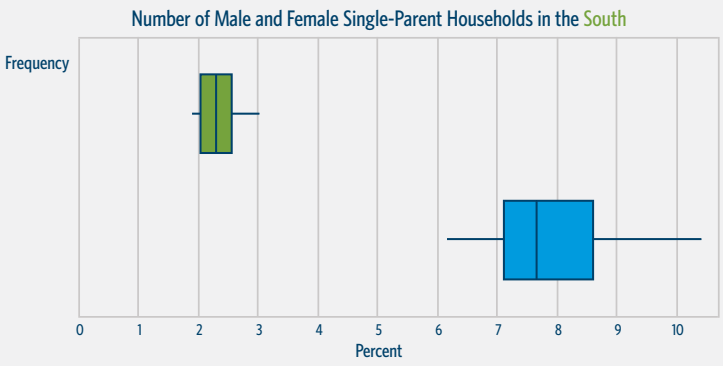
	Male Single-Parent Households	Female Single-Parent Households
Minimum	**1.9%**	**6.1%**
First Quartile	**2.0%**	**7.2%**
Median	**2.2%**	**7.6%**
Third Quartile	**2.4%**	**8.4%**
Maximum	**2.6%**	**10.3%**
Range	**0.7%**	**4.2%**
Interquartile Range (IQR)	**0.4%**	**1.2%**

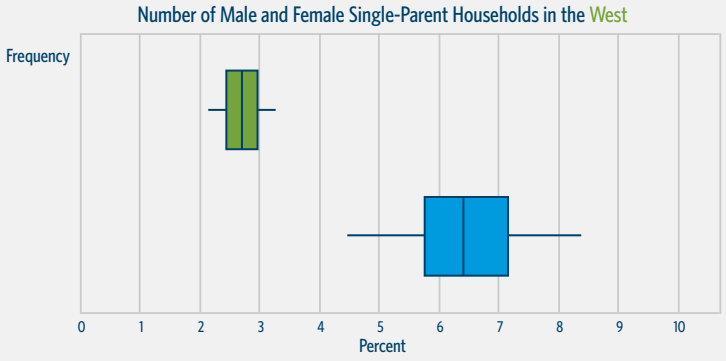
Student answers will vary depending on their region. Answers for the other regions are:

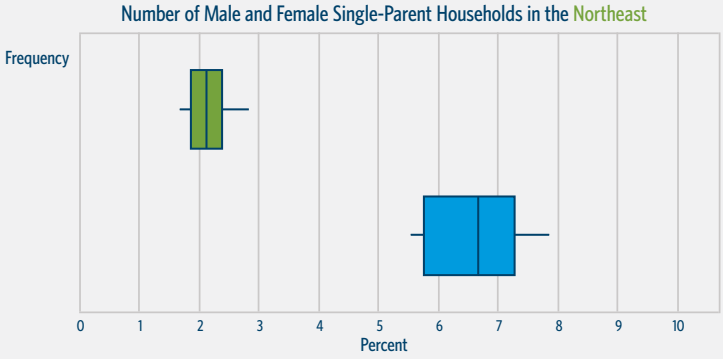
	West		Northeast		Midwest	
	Male	Female	Male	Female	Male	Female
Minimum	**2.0%**	**4.6%**	**1.8%**	**5.6%**	**2.1%**	**4.6%**
Q_1	**2.3%**	**5.85%**	**1.9%**	**5.7%**	**2.25%**	**6.3%**
Median	**2.6%**	**6.1%**	**2.1%**	**6.7%**	**2.35%**	**6.55%**
Q_3	**2.8%**	**7.2%**	**2.4%**	**7.35%**	**2.55%**	**7.2%**
Maximum	**3.2%**	**8.3%**	**2.7%**	**7.9%**	**2.8%**	**7.5%**
Range	**1.2%**	**3.7%**	**0.9%**	**2.3%**	**0.7%**	**2.9%**
IQR	**0.5%**	**1.35%**	**0.5%**	**1.65%**	**0.3%**	**0.9%**

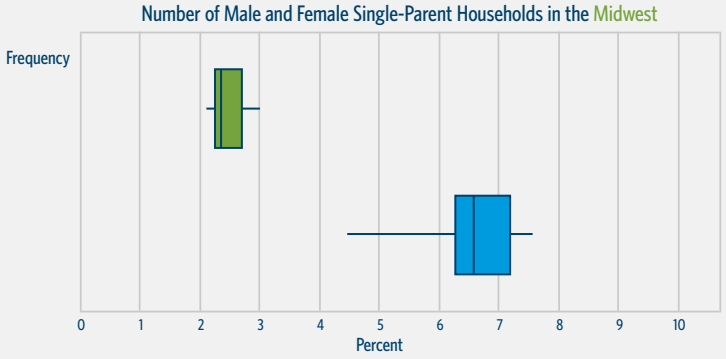
8. Now use these values to create two box plots on the graph template below — one for male and one for female single-parent households — with one above the other (doesn't matter which is on top). Make sure you fill in the blank for your region at the top, label your box plots in the blanks along the left side, and use a ruler to make each box plot neat.

Student box plots will vary depending on their region. Below are box plots for each region.









Male Female

The following sample student answers are for the South.

9. What do you notice about your box plots?

   Student answers will vary but could include: The percentages of single-parent households are smaller for men than for women.

10. How do the medians, first quartiles, and third quartiles of your box plots compare?

    The median, first quartile, and third quartile for male single-parent households are all less than the values for female ones.

11. How do the ranges of your box plots compare?

    The range for male single-parent households is 0.7 percent, while the range for the female ones is larger, at 4.2 percent.

12. How do the interquartile ranges of your box plots compare?

    The IQR for male single-parent households is 0.4 percent, while the IQR for female ones is larger, at 1.2 percent.

13. Compare your dot and box plots with those of your group members for their assigned regions. Each write three questions you could answer using anyone's plots:

    Student questions will vary but could include:

    - **Which region has the highest percentages of single-parent households overall?**
    - **Which region has the largest median percentage of single-mother households, and what is that percentage?**
    - **Which range is bigger for the Midwest: the percentages for male single-parent households or for females?**

14. Now answer three questions written by your other group members:

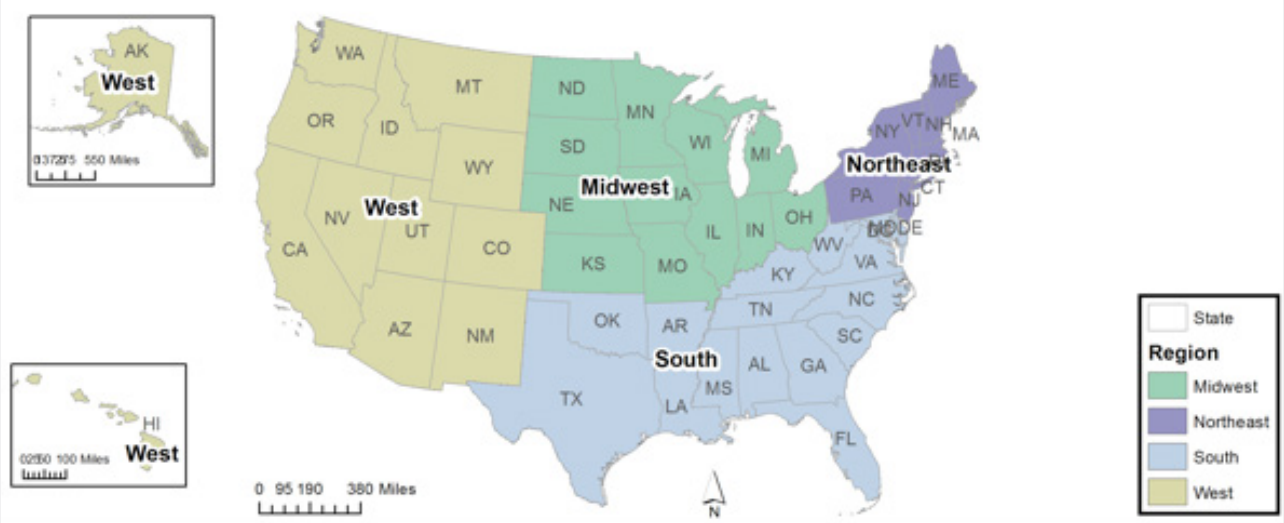
    Student responses below will vary.

    - Question:
      Answer:
    - Question:
      Answer:
    - Question:
      Answer:

15. Write a paragraph that answers this question: "How do the percentages of male and female single-parent households differ within regions and across regions?" Use the census data and your calculations to support your ideas.

    Student paragraphs will vary.

Item 1: U.S. Map of Census Bureau Regions



www.census.gov/geo/reference/webatlas/regions.html

Item 2: Single-Parent Households by Sex and Census Bureau Region: 2013

South

	Male householder, no wife present, with own children under 18 years	Female householder, no husband present, with own children under 18 years
Alabama	1.9%	8.4%
Arkansas	2.3%	7.3%
Delaware	2.2%	7.3%
District of Columbia	2.0%	7.6%
Florida	2.0%	6.9%
Georgia	2.4%	8.7%
Kentucky	2.4%	7.2%
Louisiana	2.3%	9.4%
Maryland	2.1%	7.6%
Mississippi	1.9%	10.3%
North Carolina	2.2%	7.7%
Oklahoma	2.6%	7.3%
South Carolina	2.0%	8.1%
Tennessee	2.3%	7.2%
Texas	2.4%	8.4%
Virginia	1.9%	6.7%
West Virginia	2.6%	6.1%

Item 2: Single-Parent Households by Sex and Census Bureau Region: 2013 (Continued)

West

	Male householder, no wife present, with own children under 18 years	Female householder, no husband present, with own children under 18 years
Alaska	3.2%	5.8%
Arizona	2.7%	7.4%
California	2.7%	7.0%
Colorado	2.3%	6.3%
Hawaii	2.0%	4.6%
Idaho	2.9%	6.0%
Montana	2.6%	5.9%
Nevada	2.7%	7.4%
New Mexico	3.0%	8.3%
Oregon	2.2%	6.3%
Utah	2.3%	5.4%
Washington	2.6%	6.1%
Wyoming	2.5%	5.9%

Item 2: Single-Parent Households by Sex and Census Bureau Region: 2013 (Continued)

Northeast

	Male householder, no wife present, with own children under 18 years	Female householder, no husband present, with own children under 18 years
Connecticut	1.8%	7.3%
Maine	2.7%	5.6%
Massachusetts	1.8%	6.9%
New Hampshire	2.5%	5.8%
New Jersey	2.1%	6.7%
New York	2.0%	7.4%
Pennsylvania	2.0%	6.3%
Rhode Island	2.2%	7.9%
Vermont	2.3%	5.6%

Item 2: Single-Parent Households by Sex and Census Bureau Region, 2013 (Continued)

Midwest

	Male householder, no wife present, with own children under 18 years	Female householder, no husband present, with own children under 18 years
Illinois	2.1%	6.9%
Indiana	2.5%	7.3%
Iowa	2.6%	6.1%
Kansas	2.4%	6.5%
Michigan	2.3%	7.3%
Minnesota	2.2%	6.3%
Missouri	2.2%	7.1%
Nebraska	2.3%	6.3%
North Dakota	2.6%	4.6%
Ohio	2.3%	7.5%
South Dakota	2.8%	6.6%
Wisconsin	2.4%	6.3%

factfinder.census.gov/bkmk/table/1.0/en/ACS/13_1YR/DP02/0100000US.04000

Click on the link above to view the source data.